Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

REMARKS AND ARGUMENTS

The present application includes claims 1-25. Claims 1-25 were rejected in the October 29, 2004 Office Action. Claims 1, 11, 17 and 21 were objected to in the October 29, 2004 Office Action. Claims 1-3, 11-14, 17, and 21 have been amended by this Amendment.

Claims 1, 11 and 21 are amended in response to the Examiner's objection under 37 C.F.R. § 1.75(a), (d)(1). Specifically, the Applicant has amended claims 1, 11 and 21 to more clearly define "raw image data" as "modality raw image data delivered from an imaging modality" and "partially preprocessed raw image data" as modality raw image data that has been partially preprocessed according to a predetermined subset of preprocessing functions at an acquisition workstation.

Claims 2-3 and 12-14 are amended to recite "partially preprocessed raw image data" to conform to the amendments to claims 1 and 11.

Claim 17 is amended to correct a typographical error in response to the Examiner's objection.

Claims 1, 8-9, 11, 12, and 19-21 were rejected under 35 U.S.C. § 102(b) as being anticipated by the textbook entitled "PACS Basic Principles and Applications" by Huang.

Claims 2-4, 6, 13-15, 17, 22, and 23 were rejected 35 U.S.C. § 103(a) as being unpatentable over the combination of Huang and Takeo et al. (U.S. Pat. No. 6,231,246.)

Page 11 of 28

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

Claims 5, 7, 16, 18, 24, and 25 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Huang and Takeo, further in view of Vuylsteke. (U.S. Pat. No. 5,644,662.)

Claim 10 was rejected under 35. U.S.C. § 103(a) as being unpatentable over the combination of Huang and Wofford. (U.S. Pat. No. 5,542,003.)

Summary of Remarks and Arguments

The Applicant would like to summarize its remarks and arguments as follows. The following summary is intended as a summary of previous remarks and arguments and does not introduce any new matter into the present application.

A.   Differences Between The Different Types Of Image Data

The present invention describes an acquisition workstation that accepts raw image data from an imaging modality. (See, for example, page 3, lines 24-25 and page 8, lines 13-14 of the specification.) For clarity, the raw image data from the imaging modality will be referred to herein as "modality raw image data."

Preprocessing functions are characterized as modality specific enhancements applied at the beginning of the imaging and display chain. (See, for example, page 4, lines 20-23 of the specification.) After applying preprocessing functions to modality raw image data, the modality raw image data becomes either "fully preprocessed image data" or "partially preprocessed raw image data." For clarity, "fully preprocessed image data"

Page 12 of 28

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

is modality raw image data that has had **all** of the preprocessing functions in a predetermined set of preprocessing functions applied to it. "Partially preprocessed raw image data" is modality raw image data that has had a **subset** of the preprocessing functions in a predetermined set of preprocessing functions applied to it. That is, "fully preprocessed image data" is distinguished from "partially preprocessed raw image data" because the latter has had only a subset of the preprocessing functions that are applied the former. (See, for example, page 4, lines 9-10 and page 5, lines 16-19 of the specification.)

B.   Differences Between Preprocessing And Processing Functions

Preprocessing functions differ from processing functions. (See, for example, page 4, lines 23-25 of the specification.) Preprocessing functions, as described above, are characterized in that they are modality specific enhancements applied at the beginning of the imaging and display chain. (See, for example, page 4, lines 20-23 of the specification.) Processing functions, on the other hand, are (1) applied to fully preprocessed images, (2) are not modality specific and (3) are applied at the end of the imaging and display chain. (See, for example, page 4, lines 23-25 of the specification.)

Application No. 09/473,003
Attorney Docket No. 15-1S-5283
Amendment dated January 18, 2005

C.   **Display Workstations Selectively Apply A Preprocessing Function That Differs From Preprocessing Functions Previously Applied To The Partially Preprocessed Image Data**

Display workstations may retrieve partially preprocessed raw image data from a preprocessing database. (See, for example, page 4, lines 12-15 of the specification.) The display workstation allows an operator to selectively apply one or more preprocessing functions for application to the partially preprocessed raw image data. (See, for example, page 5, lines 3-7 and 20-23 of the specification.)

As recited in claims 1, 11 and 21, a preprocessing function applied to the partially preprocessed raw image data differs from the subset of preprocessing functions already applied to the image data. As described above, the modality raw image data becomes partially preprocessed raw image data after a subset of preprocessing functions have been applied to the modality raw image data at the acquisition workstation. The display workstation may apply preprocessing functions to the partially preprocessed raw image data that were not included in the subset of preprocessing functions applied by the acquisition workstation. (See, for example, page 5, lines 11-16 of the specification.)

Therefore, in summary, for a given imaging modality, there is a known set of preprocessing functions that are typically applied to modality raw image data from that imaging modality. Some, but not all, (i.e., a subset) of the preprocessing functions in that known set are applied by the acquisition workstation to create partially preprocessed raw image data. At least one preprocessing function not included in the known subset may be applied to the partially preprocessed raw image data by the display workstation.

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

The preceding statements are intended to aid in clarifying the present invention and the Applicant's arguments, and should not be construed to introduce any new matter.

D.   Examiner's Assertions And The Applicant's Arguments

1.   Huang Does Not Teach Or Suggest Applying A Subset Of Preprocessing Functions At An Acquisition Workstation

The Applicant next turns to assertions made by the Examiner in the Office Action mailed October, 29, 2004. (Oct. 29, 2004 Office Action, pages 2-3.) The Applicant respectfully disagrees with the Examiner's assertion that "Huang discloses an acquisition computer (figure 8.14) that receives raw image data and applies a subset of preprocessing functions such as reformatting, background removal, and orientation correction (pages 225-226, section 8.8.2 and figure 8.14)." (Oct. 29, 2004 Office Action, page2.) Huang does not teach or suggest applying a **subset** of preprocessing functions. Huang instead describes applying all preprocessing functions that are required for image data obtained from a particular imaging modality. For example, Huang states:

> In addition to receiving images from imaging devices, the acquisition gateway computer **must perform certain imaging preprocessing functions** before images are sent to the PACS controller or workstations. . . . Preprocessing function is [sic] modality specific in the sense that **each imaging modality has a known set of preprocessing requirements.**

(Huang, section 8.7) (emphases added).

Therefore, under Huang, for image data obtained from an imaging modality, the acquisition gateway computer must apply a known set of preprocessing functions that are

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

associated with that imaging modality. Huang does not teach or suggest that a portion or less than all required preprocessing functions in the known set are applied to the image data. That is, Huang does not teach or suggest that only a subset of the preprocessing functions disclosed may be applied at the acquisition gateway. Huang only contemplates applying **all** of the preprocessing functions to the image data at the acquisition workstation.

In sum, Huang teaches that each imaging modality (e.g., CR, digitized X-ray images, etc.) has a **set** of preprocessing functions that **must** be applied to the image data from that modality **before** the preprocessed image data can be sent to the PACS controller or workstations. (Huang, section 8.7.) Therefore, Huang **cannot** teach or suggest that image data is only partially preprocessed before being sent to a display workstation as Huang explicitly discloses that a full set of preprocessing functions must be applied to the image data at the acquisition workstation, yielding, by definition, fully preprocessed image data.

2.   **The Generation And Application Of A Lookup Table Under Huang**

The Applicant also respectfully disagrees with the Examiner's assertion that "Huang also explains that the PACS workstation processes the same image data by applying a different preprocessing function to the image data such as a LUT (8.7.1.4)." (Oct. 29, 2004 Office Action, pages 2-3.) The Applicant disagrees with the Examiner's

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

characterization of Huang on at least two issues. First, the **generation** of a lookup table (LUT), and not the **application** of the LUT to image data, is a preprocessing function under Huang. Second, the application of an LUT at a display workstation is the processing, and not the preprocessing, of image data.

a.   The Generation, And Not The Application Of A Lookup Table Is A Preprocessing Function Performed At An Acquisition Workstation

As to the first issue, Huang clearly states that "the **generation** of a lookup table" is a preprocessing function. (Huang, section 8.7.1.4, page 222) (emphasis added). Under Huang, this preprocessing function of generating a lookup table occurs at the acquisition gateway. (Huang, section 8.7.) Huang does not teach or suggest generating an LUT at a display workstation.

b.   The Application Of A Lookup Table Is A Processing Function

As to the second issue, Huang clearly equates the application of an LUT to image data with a processing function, and not a preprocessing function, that occurs at a display workstation. The application of an LUT to image data is a processing function as Huang characterizes all image processing functions as functions that alter the appearance of an image: "processing functions are different from preprocessing functions . . . in the sense

Page 17 of 28

that preprocessing does not alter the appearance of the image, whereas processing will."
(Huang, section 12.3.1) (emphasis added).

The application of an LUT (e.g., as described in Huang, section 12.3.2.2) clearly alters the appearance of the image. For example, the application of an LUT in a "window and level feature" allows a user to alter the gray levels of an image "to be displayed on the monitor." (Huang, section 12.3.2.2) (emphasis added). Therefore, the application of an LUT at a display workstation is, under Huang, the application of a processing function, and is not the application of a preprocessing function.

3.   Summary

In sum, the Applicant again asserts that Huang does not teach or suggest (1) applying a subset of preprocessing functions to image data at an acquisition workstation or (2) that the application of an LUT to image data is the application of a preprocessing function.   As stated above, Huang clearly requires that all preprocessing functions applicable to image data obtained with a given imaging modality be applied at the acquisition workstation.   Huang does not provide for the application of a subset of preprocessing functions to image data at an acquisition workstation.   In addition, Huang clearly states that the generation of an LUT is a preprocessing function (that occurs at the display workstation), while the application of the LUT to image data is a processing function (that occurs at the display workstation). Each of independent claims 1, 11 and 21 recite partially preprocessed raw image data that has been partially preprocessed

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

according to a predetermined subset of preprocessing functions applied at an acquisition workstation. Each of independent claims 1, 11 and 21 also recite the application of a preprocessing function that differs from the subset of previously applied preprocessing functions at a display workstation. Therefore, Huang does not teach or suggest elements of at least claims 1, 11 and 21.

Objection under 37 C.F.R. § 1.75(a)

The Applicant next turns to the objection of claims 1, 11, and 21 under 37 C.F.R. § 1.75(a) and (d)(1) as failing to particularly point out and distinctly claim the subject matter which the Applicant regards as his invention or discovery. The Applicant has amended claims 1, 11, and 21 in response to the objection.

Rejections under 35 U.S.C. § 102(b)

The Applicant next turns to the rejection of claims 1, 8-9, 11, 12 and 19-21 under 35 U.S.C. § 102(b) as being anticipated by Huang. As set forth in previous Amendments, Huang discloses a picture archiving and communication system ("PACS") that consists of image and data acquisition, a PACS controller and archive, and display subsystems. (Huang, Ch. 7.1). The image and data are generated by an imaging modality. (Huang, Ch. 8.2). An acquisition gateway computer acquires the image and data from the imaging modality. (Huang, Ch. 8.2). The display subsystems display the received images. (Huang, Table 7.2).

Page 19 of 28

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

The Applicant draws particular attention to Huang's careful and specific distinction between "processing" functions and "preprocessing" functions. As stated above, Huang clearly distinguishes processing functions from preprocessing functions. (Huang, 12.3.1.). Huang clearly discloses: (1) two kinds of functions, "processing" and "preprocessing" (Huang, 12.3.1); (2) that those kinds of functions are disjoint (Huang, 12.3.1; processing alters the appearance, preprocessing does not); and (3) that the former ("processing") occur at display workstations and the latter ("preprocessing") at the acquisition gateway (Huang §§ 12.3.1.1-4 give examples of processing functions that occur at display workstations; Huang §§ 8.7.1-4 describe preprocessing functions relevant to different modalities that occur at the acquisition gateway). Thus, Huang does not and cannot teach or suggest any system or method including the application of a subset of preprocessing functions to image data at an acquisition computer and a different preprocessing function applied to the image data at a display workstation, as recited in claims 1, 11, and 21. Therefore, the Applicant respectfully submits that Huang cannot teach elements of the claimed invention.

In addition, the Examiner has asserted that "the PACS workstation inherently selects a preprocessing function when it retrieves an image from the PACS database" because "the PACS database stores a plurality of images along with the preprocessing functions, since each image contains corresponding preprocessing functions (built in or inserted into the image header)." (Office Action, mailed October, 29, 2004, pg. 5). The Applicant respectfully disagrees with these assertions. As discussed above, Huang

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

teaches the application of all preprocessing functions at the acquisition gateway. (See

Huang, 8.7). Huang does not teach or suggest that preprocessing functions are stored in a

database, as recited in claims 1, 11, and 21.

As discussed above, preprocessing functions are applied to image data from the

modality by the acquisition gateway. Huang does not teach or suggest that these

preprocessing functions are stored (before, during, or after application) in the PACS

database. Rather, Huang teaches that the results of the application of the preprocessing

functions may be stored in the image (See, e.g., Huang, 8.7.1.4, teaching that a

preprocessing function generates a lookup table, and that lookup table may subsequently

be stored in the image header for later application by processing functions). Thus, Huang

does not teach or suggest selecting a preprocessing function from a database because

Huang does not teach or suggest a preprocessing function stored in a database.

Further, the Applicant draws particular attention to currently amended claim 21,

which specifically recites that the preprocessing function is stored in the preprocessing

database. Huang does not (and cannot) teach or suggest a preprocessing database that

stores partially preprocessed raw image data. (See, e.g., spec. pg. 4, lines 8-10). As

discussed above, Huang clearly states "the acquisition gateway computer **must perform**

certain image preprocessing functions before images are sent to the PACS controller

or workstations." (Huang, 8.7). Huang does not teach or suggest partially preprocessed

raw image data being communicated from the acquisition gateway. Therefore, Huang

cannot teach or suggest a preprocessing database that stores partially preprocessed raw

Page 21 of 28

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

image data as recited in claim 21. In addition, Huang cannot teach or suggest partially preprocessed raw image data being stored in the PACS database, as recited in claims 1 and 11, because only fully preprocessed image data is sent to the PACS controller or workstations.

The present rejection encompasses claims 1, 8-9, 11, 12, and 19-21. Claims 1, 11, and 21 have been amended to more clearly recite limitations previously submitted as not taught by Huang. Claims 8-9, 12, and 19-20 depend from claims 1, 11, and 21. Therefore, the Applicant respectfully submits that claims 1, 8-9, 11, 12, and 19-21 should be allowable.

Rejections under 35 U.S.C. § 103(a)

The Applicant next turns to the rejection of claims 2-4, 6, 13-15, 17, 22 and 23 under 35 U.S.C. § 103(a) as being unpatentable over Huang and Takeo. As set forth in previous Amendments, Takeo describes a method and apparatus for reproducing an image via two image-reproducing devices wherein gradation and/or sharpness correction is performed for both images reproducing devices.

However, Takeo does not overcome the shortcomings of Huang, as described above. Specifically, Takeo does not teach retrieving partially preprocessed raw image data that has been partially preprocessed according to a subset of preprocessing functions at an acquisition workstation, followed by the application of a different preprocessing function at a display workstation, as recited in claims 1, 11 and 21. Takeo instead

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

describes the complete and full processing of image data (signal S, which is not disclosed

to have been preprocessed or processed to delivery to the image processing means 1) at

an image processing means for two differing outputs (namely, a CRT display device and

a laser printer) before sending the fully processed image data to those outputs – the

display device (for display) and to the laser printer (for reproduction) (col. 6, lines 32-

49).

Takeo merely describes the application of all processing functions at a single

location, namely the image processing means 1 of FIG. 1 (col. 6, lines 37-41). Takeo is

therefore incapable of teaching or suggesting the retrieval of partially preprocessed raw

image data that has been partially preprocessed according to a subset of preprocessing

functions at an acquisition computer followed by the application of a different

preprocessing function at a display workstation, as recited in claims 1, 11 and 21. Thus,

the Applicant respectfully submits that Takeo also fails to teach or suggest elements of

the present claims.

Moreover, assuming for the sake of argument that one would be motivated to

combine Huang and Takeo, a combination of Huang and Takeo would similarly fail to

teach or suggest elements of the present claims. As described above, neither Huang nor

Takeo teach or suggest retrieving partially preprocessed raw image data that has been

partially preprocessed according to a subset of preprocessing functions at an acquisition

workstation, followed by the application of a different preprocessing function at a display

workstation, as described in claims 1, 11 and 21. Therefore, the Applicant respectfully

Page 23 of 28

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

submits that a combination of Huang and Takeo does not teach or suggest elements of the present claims.

The present rejection encompasses claims 2-4, 6, 13-15, 17, 22 and 23. Claims 1, 11 and 21 have been amended to more clearly recite limitations previously submitted as not taught or suggested by Huang or Takeo, alone or in combination. Claims 2-4, 6, 13-15, 17, 22 and 23 depend from claims 1, 11 and 21. Therefore, the Applicant respectfully submits that claims 2-4, 6, 13-15, 17, 22 and 23 should be allowable.

The Applicant next turns to the rejection of claims 5, 7, 16, 18, 24 and 25 under 35 U.S.C. § 103(a) as being unpatentable over Huang and Takeo, further in view of Vuylsteke. As set forth in previous Amendments, Vuylsteke describes multiple processing of radiographic images based on a pyramidal image decomposition.

However, Vuylsteke does not overcome the shortcomings of either Huang or Takeo, as described above. Specifically, Vuylsteke merely describes the iterative decomposition of an image into multiple levels of lower resolution, the processing of the image, then applying the inverse of the transform that decomposed the original image (col. 2, lines 33-56; col. 6, lines 10-27). Vuylsteke describes sending an original image being sent to an image processor (7) by an image read-out apparatus (1). (col. 5, lines 46-49; col. 6, lines 5-6; FIG. 1). The imaging signal is then processed and then sent to an output device (6). (col. 5, lines 49-51). Therefore, Vuylsteke is incapable of teaching or suggesting retrieving partially preprocessed raw image data that has been partially

Page 24 of 28

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

preprocessed according to a subset of preprocessing functions at an acquisition workstation, followed by the application of a different preprocessing function at a display workstation, as recited in claims 1, 11 and 21. Thus, the Applicant respectfully submits that Vuylsteke also fails to teach or suggest elements of the present claims.

Moreover, assuming for the sake of argument that one would be motivated to combine Huang, Takeo and Vuysteke, a combination of Huang, Takeo and Vuylsteke similarly fails to teach or suggest elements of the present claims. As described above, none of Huang, Takeo and Vuylsteke teach or suggest retrieving partially preprocessed raw image data that has been partially preprocessed according to a subset of preprocessing functions at an acquisition workstation, followed by the application of a different preprocessing function at a display workstation, as described in claims 1, 11 and 21. Therefore, the Applicant respectfully submits that a combination of Huang, Takeo and Vuylsteke does not teach or suggest elements of the present claims.

The present rejection encompasses claims 5, 7, 16, 18, 24 and 25. Claims 1, 11 and 21 have been amended to more clearly recite limitations previously submitted as not taught or suggested by Huang, Takeo or Vuylsteke, alone or in combination. Claims 5, 7, 16, 18, 24 and 25 depend from claims 1, 11 and 21. Therefore, the Applicant respectfully submits that claims 5, 7, 16, 18, 24 and 25 should be allowable.

The Applicant next turns to the rejection of claim 10 under 35 U.S.C. § 103(a) as being unpatentable over Huang and Wofford. As set forth in previous Amendments,

Page 25 of 28

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

Wofford describes a method for maximizing fidelity and dynamic range for a region of interest ("ROI") within digitized medical image display.

However, Wofford does not overcome the shortcomings of Huang, as described above. Specifically, the entire invention of Wofford, including all image processing of data, occurs at a display workstation (col. 4, lines 53-61). In this way, as no type of image processing or preprocessing occurs at an acquisition gateway computer, Wofford is therefore incapable of describing the application of a subset of preprocessing functions to image data at an acquisition computer and a different preprocessing function to the image data at a display workstation, as recited in claim 1. Thus, the Applicant respectfully submits that Wofford is incapable of teaching or suggesting elements of the claimed invention.

Moreover, assuming for the sake of argument that one would be motivated to combine Wofford and Huang, a combination of Wofford and Huang similarly fails to teach or suggest elements of the present claims. As described above, neither of Huang and Wofford teach or suggest the application of a subset of preprocessing functions to image data at an acquisition computer and the application of a different preprocessing function at a display workstation, as described in claim 1. Therefore, the Applicant respectfully submits that a combination of Wofford and Huang does not teach or suggest elements of the present claims.

The present rejection encompasses claim 10. Claim 1 has been amended to more clearly recite limitations previously submitted as not taught or suggested by Huang or

Page 26 of 28

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

Wofford, alone or in combination. Claim 10 depends from claim 1. Therefore, the
Applicant respectfully submits that claim 10 should be allowable.

Therefore, the Applicant respectfully submits that the claims of the present
application should be allowable over the prior art.

Application No. 09/473,003
Attorney Docket No. 15-IS-5283
Amendment dated January 18, 2005

CONCLUSION

If the Examiner has any questions or the Applicant can be of any assistance, the Examiner is invited and encouraged to contact the Applicant at the number below.

The Commissioner is authorized to charge any necessary fees or credit any overpayment to the Deposit Account of GTC, Account No. 07-0845.

Respectfully submitted,

Date: _January 18, 2005_

Christopher R. Carroll
Christopher R. Carroll
Registration No. 52,700

McANDREWS, HELD & MALLOY, LTD.
500 West Madison Street, 34th Floor
Chicago, IL 60661

Telephone: (312) 775-8000
Facsimile: (312) 775-8100

Page 28 of 28

PAGE 30/30 * RCVD AT 1/18/2005 3:11:26 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/11 * DNIS:8729306 * CSID:3127079155 * DURATION (mm-ss):06-54